INTERNATIONAL
ASSOCIATION FOR TESTING MATERIALS.

AMERICAN SECTION.

BULLETIN No. 9. MAY, 1900.

PROPOSED STANDARD SPECIFICATIONS
FOR
STRUCTURAL STEEL FOR BUILDINGS.

RECOMMENDED BY AMERICAN BRANCH OF COMMITTEE No. 1, MAY 1, 1900.

There will be a discussion of these specifications at the Third Annual Meeting of the American Section, to be held in New York, on October 25-27, 1900, and you are requested to send in your views by letter, or to be present and take part in the oral discussion.

After the Annual Meeting, Committee No. 1 will consider the points raised, and make any modifications that may be found necessary; and, if so decided at the Annual Meeting, the specifications will be sent to all members of the American Section for approval by letter ballot.

If the other countries perform their work in the same general manner, the final work of the introduction of International Specifications will be reduced to a very simple matter, as there will only be a limited number of specifications to consider instead of hundreds as at the present time.

WM. R. WEBSTER,
Chairman of American Branch of Committee No. 1.

Process of Manufacture.

1. Steel may be made by either the open-hearth or Bessemer process.

Chemical Properties.

2. Each of the two classes of structural steel for buildings shall not contain more than 0.10 per cent. of phosphorus.

Physical Properties.

3. There shall be two classes of structural steel for buildings, namely: RIVET STEEL and MEDIUM STEEL which shall conform to the following physical qualities:

Classes.

4.

Tensile Tests.

	Rivet steel.	Medium steel.
Tensile strength, pounds per square inch	50,000 to 60,000	60,000 to 70,000
Yield point, in pounds per square inch shall not be less than	30,000	35,000
Elongation, per cent. in eight inches shall not be less than	26	22

5. For material less than five-sixteenths inch (5/16″), and more than three-fourths inch (3/4″) in thickness, the following modifications shall be made in the requirements for elongation:

Modifications in elongation for thin and thick material.

(*a*). For each increase of one-eighth inch (1/8″) in thickness above three-fourths inch (3/4″), a deduction of one per cent. (1 %) shall be made from the specified elongation.

(*b*). For each decrease of one-sixteenth inch (1/16″) in thickness below five-sixteenths inch (5/16″) a deduction of two and one-half per cent. (2 1/2%) shall be made from the specified elongation.

(*c*). For pins the required elongation shall be five per cent. (5%) less than that specified in paragraph No. 4, as determined on a test specimen the center of which shall be one inch (1″) from the surface.

Name and Date.	Chemistry A = Acid O. H. B = Basic O. H.					Annealing Specimens.	Tensile strength, pounds per sq. inch.			Elastic limit, pounds per	
	Phos.	Sul.	Sil.	Mn.	Remarks.		Soft.	Medium.	Rivet.	Soft.	Me
Association American Steel Manufacturers, July 17, 1896	.08 .10	Bess. or O. H.		... .	R.R. bridges. Hy. br. and bldg.	Annealed specimens for material that is to be annealed.	52,000 62,000	60,000 70,000	48,000 58,000	½ ult. "	½ "
Atchison, Topeka & S. F., Oct., 1895	.08	....	....	....	....	....	54,000 62,000	60,000 68,000	.....	32,000	3
Baltimore & Ohio, 1896	.08A .05B	....	....	....	....	Annealed specimens for material that is to be annealed	52,000 60,000	60,000 68,000	....	28,000 or ½ ult.	3 or
B. & O. Southwestern, 1898	.08 .06	.06 .05	... .	.. ..	A. or Bess. B	....	4,000 62,000	60.000 70,000	.....	33,000	
Boston, City of, 1899	.08A .06B	....	....	....	Rivet steel. Phos. .06	....	.....	60.000 68.000	48,000 58,000	....	½ ....
Buffalo, Rochester & Pgh., 1898	.06A .04B	.05A .04B	.05	.60	....	Annealed specimens for material that is to be annealed.	50,000 60,000	60,000 68,000	.....	55% ult., 1 in. and less. 50% ult. over 1 in.	55% ult 50% ult
Cin., N. O. & Tex. Pacific Ry., July, 1898	.04A .03B	.02	.05	.60	Med. Phos. .05A " " .03B	....	52,000 62,000	62,000 70,000	.....	32,000	
Theo. Cooper, 1896	....	Bess. or O.H.	....	....	....	Annealed specimens for material that is to be annealed.	54,000 62,000	60,000 68,000	50,000 58,000	½ ult.	½ ....
Chicago & Northwestern, 1899	.08A .04B	.04A .04B	.. ....	....	....	....	50,000 60,000	60.000 70,000	48,000 58,000	½ ult.	½ ....
C. M. & St. P. Ry., 1898	.08A .05B	.05A .05B	....	....	....	....	....	55,000 65,000	47,000 57,000	....	½ ....
C. M. & St. P. Ry., June 14, 1898	.08A .05B	.05A .05B	....	....	....	....	....	60,000 68,000	48,000 56,000	....	½ ....
Illinois Central Ry., 1899	.08A .04A	.04A .04B	....	....	....	....	50.000 58,000	58,000 65,000	.....	30,000	
King Bridge Co	.10	Bess. or O. H.	....	....	....	....	52,000 62,000	60,000 70,000	....	½ ult.	½ ....
L. S. & M. S. Ry., June, 1894	.08A .04B	....	....	....	....	....	56,000 64,000	....	.....	60% ult.	....
Missouri Pacific Ry., Jan. 1, 1899	.10	Bess. or O. H.	....	....	....	....	54,000 62,000	60,000 68,000	.....	32,000	
N. Y. C. & H. R. R. R., 1899	.08A .04B	.05	....	....	....	Annealed specimens for material that is to be annealed.	56,000 64,000	62,000 70,000	48,000 56,000	60% ult., ⅝ in. t and under. 55% ult. over ⅝ in.	60 ....
Northern Pacific Ry., Dec. 1, 1898	.08A .04B	....	....	....	....	....	52,000 60,000	62.000 70 000	.....	30,000	
Osborn Co., R.R. bridges, 1896	.08A .04B	....	....	....	....	....	52,000 62,000	60,000 70,000	.....	31,000	
Osborn Co., highway bridges, 1895	.08A .04B	....	....	....	....	....	52,000 62,000	60,000 70,000	.....	31,000	
Pennsylvania Lines West of Pittsburgh, April, 1897	.08A .04B	....	....	....	....	....	54,000 62,000	62.000 70,000	52,000 58,000	55% ult.	55 ....
Pennsylvania Railroad, Jan. 1, 1897	.06A .04B	....	..	....	....	Not annealed.	52.000 62,000	62,000 70,000	48,000 56,000	28,000	
J. A. L. Waddell	.05A .03B	.04	.04 ..	.60	Soft, see remarks.	Annealed specimens for material that is to be annealed.	50,000 60,000	60,000 70,000	....	30,000	
Canadian Pacific Ry., 1898	.065	....	...	.50	....	....	.....	58,000 65,000	.....	....	
Grand Trunk Ry., Nov. 17, 1897	.08A .04B	....	..	....	....	Annealed sample for material that is to be annealed.	54,000 62,000	60 000 68,000	.....	½ ult.	½ ....
Dominion Government, 1899	.08A .04B	.04A .04B	....	....	....	....	50,000 58,000	60.000 68,000	.....	30,000	
Mexican Central, 1898	.04	....	.. ...	....	....	Annealed sample for material that is to be annealed.	.....	60.000 68.000	50,000 55,000	....	½ ....
C. B. & Q. Ry., 1898	.08A .05B	....	.. ...	....	....	....	52,000 62,000	60,00C 70,000	....	½ ult.	½ ....
Great Northern Ry., Mar. 1, 1898	.08A .04B	....	...	....	Bess. Phos. .06	....	52,000 62,000	60,000 70,000	48.000 56,000	55% ult.	55 ....
Michigan Central Ry. 1899	.075A .04B	.04 med.	....	.. .	Soft. Phos. and sul. .01	....	50,000 60,000	57,000 66,000	.....	55% ult.	55 ....
Southern Railway, 1897	.08A .05B	....	...	...	....	....	52,000 62,000	60.000 70,000	48,000 58,000	28,000	
Union Pacific Ry, 1898	.06A .04B	.05A .05B	....	....	....	....	50,000 58,000	60,000 68.000	.....	½ ult.	½ ....
Wabash R.R., Mar., 1898	Phos. specified for each order.		....	....	....	....	52,000 60,000	60,000 70,000	48,000 60,000	½ ult.	½ ....
Pencoyd Iron Works, April, 1895	.08	....	....	....	O. H.	....	50,000 60,000	60,000 70,000	.....	½ ult.	½ ....
N. Y. N. H. & H. R.R., 1894	.06	.05	....	.45	....	....	56 000 64,000	.....	50,000 54,000	35,000	...
Chicago & Alton, Oct., 1897	.08A .04B	....	..	....	....	....	54,000 62,000	62 000 70,000	48,000 56,000	½ ult.	½ ....
Philadelphia & Reading	.07A .04B	....	...	....	....	....	57,000 65,000	.....	Not over 60 000	54% ult.	....
Plant System Rys., June 2, 1896	.08	....	..	....	....	....	52,000 62,000	60,000 68,000	.....	34,000	
Robert Moore	.08A .04B	....	....	....	....	....	56,000 66,000	...	.....	....	....
Southern Indiana R.R. Co.	.08A .04B	.10	....	....	Bess phos. .06 Rivets sul. .06	....	54,000 62,000	60,000 68,000	48,000 58,000	30,000	
Chesapeake & Ohio, Feb., 1896	.08A .05B	....	....	....	....	....	52,000 60,000	60,000 68,000	.....	30,000	
Boston Elevated Ry., 1898	.08A .04B	.05	..	....	Rivets phos. .03	....	48,000 56,000	60,000 68,000	.....	30,000	

C., C., C. & St. L.—Specifications practically same as B. & O. S. W. for quality. C.R. I. & P. and Chicago & Western Indiana, same as Chicago

SYNOPSIS OF SPECIFICATIONS FOR ROLLED STEEL.

COMPILED FOR COMMITTEE No. 1.—AMERICAN SECTION INTERNATIONAL ASSOCIATION FOR TESTING MATERIALS.

Physical requirements.

...unds per sq. inch.			Elongation, % in 8 in.			Reduction of area, %.			Bending. {H. = hot. C. = cold, D. = diameter. Q. = quench.			Drift test diameter to be increased.	Pins.
	Medium.	Rivet.	Soft.	Medium.	Rivet.	Soft.	Medium.	Rivet.	Soft.	Medium.	Rivet.		
	½ ult.	⅛ ult.	25	22	26	.....	.....	....	180° flat	180° D. = t	180° flat	.....	Reduce el. 5%
	"	"	25	22	26	.....	.....	....	.....	.....	.....	.....	"
	36,000	... .	25	20	....	50	40	..	180° flat C., Q.	180° D. = t C., Q.	....	Soft 100% Med. 50%	el. 5% Red. 10% } Less.
	32,000, or ½ ult.	.....	25	20	.....	.....	.....	....	180° flat Thick 180%	Material over 1 in. D. = 1½ in. t	C.	100% Punch test.	Medium el. 16%
	32,000	.....	25	23	.....	50	43	....	180° flat C., Q.	180° D. 1½ in. t C., Q.	.....	Hammer test	.....
	½ ult.	½ ult.	.....	20	26	.....	.....	....	....	180° D. = t C.	180° flat C. 100° t = Q.	....	Reduce el., 5%
	55% ult. 1 in. and 50% ult. over 1 in.	less.	25	20	.....	.....	.....	....	180° flat C.	180° D. = t C.	....	50%	.....
	35,000	.....	26	24	.....	50	40	..	180° flat C.	180° flat C.	.....	Hammer test	.....
	½ ult.	½ ult.	25	22	26	.....	.....	.	180° D. = t C. & Q.	180° D. 1½ in. t C. & Q.	180° flat	33⅓%	el., 15%
	½ ult.	½ ult.	26	22	26	.....	.....	....	180° flat C.	180° D. = t C.	180° flat C.	.....	Reduce el., 5%
	½ ult.	½ ult.	1.500000 ÷ ult.			.....	.....	....	180° flat C. 180° D. = t C.	½ in. t or less over ½ in. t	180° flat C.	50%	Reduce el., 5%
	½ ult.	½ ult.	1.500000 ÷ ult.			.....	.....	..	180° flat C. 180° D. = t C.	½ in. t or less over ½ in. t	180° flat C.	50%	Reduce el., 5%
	34,000	.....	28	20	.....	50	44	....	180° D. = t C. & Q.	180° D. = t C & Q.	.....	80%	.....
	½ ult.	.....	25	22	....	50	40	..	180° flat C.	180° D. = t C.	.....	.....	Reduce el., 5%, Red., 10%
			28	.....	.....	45	.....	....	180° flat C.	.....	.....	50%	.....
	34,000	.....	26	22	.....	50	40	...	180° flat	180° D. = t	.....	100% Punch test	.....
der.	60% ult.	.....	26	25	28	50	45	55	180° flat C.	180° D. = t C.	180° flat	soft 50%	.....
	37,000	....	26	22	.....	.....	.....	....	180° flat	180° D. = t	.....	38.7%	Reduce el , 10%
	35,000	.. ....	26	24	.....	50	45	....	180° flat C., & Q.	180° D. = t C. & Q.	.....	6⅔%	.....
	35,000	.....	25	20	.....	50	40	....	180° flat C., & Q.	180° D. = t C & Q.	.....	Hammer test	.....
	55% ult.	55% ult.	1.500000 ÷ ult.			2.800000 ÷ ult.			180° flat	180° flat	180° flat	50%	.....
									C.	C.	C.	.....	.....
	33,000	28,000	25	17	28	50	40	56	180° flat C.	180° D. = t C.	180° flat C.	50%	.....
	35,000	.....	26	24 to 20	.....	.....	.....	....	180° flat H., C., Q.	180° D. = t H., C., Q.	.....	50% med. 25% high	.....
	33,000	.....	.....	20	.....	48	36	....	.....	.....	.....	100%	.....
	½ ult.	.....	25	22	.....	.....	.....	....	180° flat C.	180° D. = 1½ in. t H., C., Q.	.....	50%	Reduce el., 5%
	32,000	.... ..	25	22	.....	50	42	...	180° flat C.	180° D. = t over ½ in. D. = 1½ in. t	.....	50%	.....
	½ ult.	.....	.....	22	26	.....	...	50	.....	180° D. = 2 in. H , C., Q.	180° flat C.	33⅓%	el., 16%
	½ ult.	.....	25	22	.....	50	40	....	180° flat C.	180° D. = t	.....	.....	.....
	55% ult.	55% ult.	26	22	28	.....	.....	....	180° flat C.	180° D. = t C.	180° flat C.	30%	Reduce el., 5%
	55% ult.	.....	27	26 See remarks	.....	55	50	...	180° flat	180° flat	.....	.....	.....
	32,000	26,000	25	22	26	40	40	45	180° flat	180° D. = t	180° flat C.	50%	.....
	½ ult.	.....	25	22	.....	50	44	....	180° D. = 1½ in. t C. & Q.	180° D. = 1½ in. t C. & Q.	.....	50%	.....
	½ ult.	½ ult.	25	22	26	50	45	50	180° flat	180° D. = t H., C., Q.	180° flat	50%	.....
	½ ult.	.....	26	22	.....	.....	.....	..	180° flat	180° D. = 2 in. H., C., Q.	.....	33⅓%	Reduce el., 5%
	.. ..	.. ....	25	.....	.....	30	50	...	180° flat C.	1 in. t or less over 1 in. t	{Quench {Bend 180° D. t	50%	Reduce el., 5%
	.....	.....	.....	.....	.....	.....	.....	....	180° D. = 1¼ in. C.		Punch test	.....	el., 10%
	½ ult.	½ ult.	26	22	28	.....	.....	....	180° flat H., C.	180° D. = t H., C.	180° flat H., C.	.....	.....
	.....	.....	25	.....	.....	.....	.....	..	180° D. = 2 in.	.....	180° flat	33%	.....
	.....	.....	22 plts. over 16 in. wide. 20 " " 42 " "			.....	.....	....	H., C., Q.	.....	.....	.....	.....
	36,000	.....	26	20	.....	50	45	....	180° flat C. & Q.	180° D. = 2 in. t C. & Q.	.....	100% soft 66⅔% med.	.....
	.....	.....	25	.....	.....	.....	.....	....	180° D = t Q.	.....	.....	.....	.....
	34,000	24,000	25	22	26	50	45	50	180° D. = t C.	180° D. = t	180° D. = t C. 180° flat Q.	37.5% soft 25% med.	.....
	35,000	.....	25	20	.....	.....	.....	....	180° flat C. & Q.	180° D = 1½ in. t C. & Q.	.....	.....	.....
	½ ult.	.....	28	22	.....	50	40	....	180° flat C.	180° D. = t Q.	.....	50%	.....

s Chicago & Alton. Lehigh Valley same as Theo. Cooper's. New York, Chicago & St. Louis and Cleveland, Lorain & Wheeling, January, 1900, same as Osborn'

SYNOPSIS OF SPECIFICATIONS FOR ROLLED STEEL.

COMPILED FOR COMMITTEE No. 1.—AMERICAN SECTION INTERNATIONAL ASSSOCIATION FOR TESTING MATERIALS.

Physical requirements.									Variation in weight, %.		Re
8 in.	Reduction of area, %.			Bending. {H. = hot. C. = cold, D. = diameter. Q. = quench.			Drift test diameter to be increased.	Pins.	Sections.	Entire order.	Tensile strength, lbs. per sq. in.
Rivet.	Soft.	Medium.	Rivet.	Soft.	Medium.	Rivet.					
26	.....	.....	...	180° flat	180° D. = t	180° flat	.....	Reduce el. 5%	2½ except plts.	.....	5,000 below min. for spec.
26	.....	.....	...	.....	.....	.....	.....	"	.....	.....	.....
....	50	40	..	180° flat C., Q.	180° D. = t C., Q.	....	Soft 100% Med. 50%	el. 5% Red. 10% } Less.	.....	2½	58,000
.....	.....	.....	...	180° flat Thick 180%	Material over 1 in. D. = 1½ in. t	C.	100% Punch test.	Medium el. 16%	2½	.....	58,000
.....	.....	.....	...	.....	.....	.....	.....	.....	.....	.....	.....
.....	50	43	....	180° flat C., Q.	180° D. 1½ in. t C., Q.	.....	Hammer test	.....	2½	.....	58,000
.....	.....	.....	...	.....	.....	.....	.....	.....	.....	.....	.....
26	.....	.....	...	.....	180° D. = t C.	180° flat C. 100° t = Q.	.....	Reduce el., 5%	.....	.....	.....
.....	.....	.....	...	180° flat C.	180° D. = t C.	.....	50%	.....	2 to 8 for plts.	2	56,000, 2 in and over 60,000, 1 in and under
.....	50	40	..	180° flat C.	180° flat C.	.....	Hammer test	.....	2½ to 8 for plts.	.....	56,000, 2 in. and over 60,000, 1 in. and under
26	.....	.....	.	180° D. = t C. & Q.	180° D. 1½ in. t C. & Q.	180° flat	33⅓%	el., 15%	2½	.....	55,000
26	.....	.....	...	180° flat C.	180° D. = t C.	180° flat C.	.....	Reduce el., 5%	2½	.....	5,000 Below specimen
lt.	.....	.....	...	180° flat C. 180° D. = t C.	½ in. t or less over ½ in. t	180° flat C.	50%	Reduce el., 5%	2½	2	.....
lt.	.....	.....	..	180° flat C. 180° D. = t C.	½ in. t or less over ½ in. t	180° flat C.	50%	Reduce el., 5%	2½	2	5,000 Below specimen
.....	50	44	...	180° D. = t C. & Q.	180° D. = t C & Q.	.....	80%	.....	.....	.....	54,000
....	50	40	..	180° flat C.	180° D. = t C.	.....	.....	Reduce el., 5%, Red., 10%	2½	.....	Specimen tests cut from quality
....	45	.....	....	180° flat C.	.....	.....	50%	.....	.....	.....	Order material to give specimen
.....	50	40	...	180° flat	180° D. = t	.....	100% Punch test	.....	.....	.....	4,000 below Min. for specimen
28	50	45	55	180° flat C.	180° D. = t C.	180° flat	soft 50%	.....	2½ above 1½ below	.....	58,000
.....	.....	.....	....	180° flat	180° D. = t	.....	38.7%	Reduce el , 10%	2½	.....	57,000
.....	50	45	....	180° flat C., & Q.	180° D. = t C. & Q.	.....	66⅔%	.....	2½ except plts.	....	53,000
.....	50	40	....	180° flat C., & Q.	180° D. = t C & Q.	.....	Hammer test	.....	2½	....	56,000
lt.	2.800000 ÷ ult.			180° flat C.	180° flat C.	180° flat C.	50%	.....	2½ down to 5 for plts.	.....	$62{,}000 - \frac{9\,000\ A}{P}$ / $54{,}000 - \frac{8{,}000\ A}{P}$
28	50	40	55	180° flat C.	180° D. = t C.	180° flat C.	50%	.....	2½ except extra wide plts.	.....	48,000
.....	48	36	....	180° flat H., C., Q.	180° D. = t H., C., Q.	.....	50% med. 25% high	.....	2 up to 8 for plts.	1 to 2	56,000, 2 in. and over 60,000, 1 in. and under
.....	.....	40	....	.....	.....	.....	100%	.....	.....	.....	58 000 to 65,000
.....	.....	.....	....	180° flat C.	180° D. = 1½ in. t H., C., Q.	.....	50%	Reduce el., 5%	2½	.....	58 000 56,000
.....	50	42	....	180° flat C.	180° D. = t over ½ in. D. = 1½ in. t	.....	50%	.....	.....	.....	56,000, 6 in. sq. & less 54,000 over 6 sq. in.
26	.....	...	50	.....	180° D. = 2 in. H , C., Q.	180° flat C.	33⅓%	el., 16%	.....	....	56,000
.....	50	40	....	180° flat C.	180° D. = t	.....	.....	.....	2½	.....	55,000 to 65,000
28	.....	.....	....	180° flat C.	180° D. = t C.	180° flat C.	30%	Reduce el., 5%	2½ except wide plts.	.....	52,000 soft 56,000 med.
.....	55	50	...	180° flat	180° flat	.....	.....	.....	2½	.....	.....
26	40	40	45	180° flat	180° D. = t	180° flat C.	50%	.....	.....	.....	.....
.....	50	44	....	180° D. = 1½ in. t C. & Q.	180° D. = 1½ in. t C. & Q.	.....	50%	.....	2½ except plts.	.....	.....
26	50	45	50	180° flat	180° D. = t H., C., Q.	180° flat	50%	.....	2½	2	58,000
.....	.....	.....	..	180° flat	180° D. = 2 in. H., C., Q.	.....	33⅓%	Reduce el., 5%	2½	.....	.....
30	50	...	60	180° flat C.	1 in. t or less over 1 in. t	{ Quench { Bend 180° D. t	50% Punch test	Reduce el., 5% el., 10%	2½	.....	.....
28	.....	.....	....	180°D. = 1¼ in. C. 180° flat H., C.	180° D. = t H., C.	180° flat H., C.	.....	.....	2½ except plts. over 40 in.	.....	58,000
n. wide.	....	.....	..	180° D. = 2 in.	.....	180° flat	33⅓	.....	2½	....	.....
"	....	....	....	H., C., Q.	.....	.....	.....	.....	.....	....	.....
.....	50	45	....	180° flat C. & Q.	180° D. = 2 in. t C. & Q.	.....	100% soft 66⅔% med.	.....	2½	....	56,000
..	.....	.....	....	180° D = t Q.	.....	.....	.....	.....	2½	.....	.....
26	50	45	50	180° D. = t C.	180° D. = t	180° D. = t C. 180° flat Q.	37.5% soft 25% med.	.....	2½	.....	52,000 soft 58,000 med.
..	.....	.....	....	180° flat C. & Q.	180° D = 1½ in. t C. & Q.	.....	.....	.....	.....	.....	60,000 med. 52,000 soft
..	50	40	....	180° flat C.	180° D. = t Q.	.....	50%	.....	2½	...	.....

eo. Cooper's. New York, Chicago & St. Louis and Cleveland, Lorain & Wheeling, January, 1900, same as Osborn's Railway. New York, Ontario & Western and

Requirements full-sized eye bars.				Remarks.
	Elastic limit, lbs. per sq. in.	Elongation, %.	Breakage.	
. for	.....	10 body of bar.	Not more than ⅛ to break in head.	Eye bar matl over 1½ in. thick; reduce elong. 1% for each ⅛ in. increase in thickness down to 20% for med. and 22% for soft.
	32,000	15 in 10 ft.	.....	Soft steel web plts. over 33 in. wide may have 20% elong. and 40% reduction.
	⅛ ult.	13 in 20 ft. Down to 8 for longer lengths.	.....	Opening and closing tests for angles.
	29,000	18 in 12 in. 12 balance.	Red. 40%.	
	.....	.....	.....	
over nder	½ ult.	14 in 10 ft.	All bars must break in body.	
over nder	50% ult. 2 in. over 55% ult., 1 in. under	14 in 10 ft.	.....	
	.....	10	Not more than ⅛ to break in head.	Eye bar material over 1½ in. thick reduce elongation 1% for each ⅛ in. increase in thickness down to 20%.
	.....	10 in 15 ft.	Not more than ⅛ to break in head.	Eye bar mater al over 1½ in. thick reduce elongation 1% for each ⅛ in. increase in thickness down to 2% for med. and 22% for soft.
nen	.....	.....	Not more than ⅛ to break in head.	T. S. to average within 2,500 lbs. of 52,000 and 60,000 for rivet and balance respectively. Opening and closing tests for angles.
	.....	.....	Not more than ⅛ to break in head.	
nen	.....	15 in 15 ft.	Not more than ⅛ to break in head.	T. S. to average within 2,500 lbs of 52,000 lbs. and 64,000 lbs. for rivets and balance respectively. Opening and closing tests for angles.
	28,000	10	.....	
cut from annealed bars to determine			Not more than ⅛ to break in eye.	High steel T. S. 66,000 to 76,000 lbs., el. 18% in 8 in., reduce 3½% C. B. 180% D. = 3 t.
to give same results as		15	.....	
men	⅛ ult.	13 in 20 ft.	.....	
	33,000	16 in 20 ft.	.....	Rollers and roller plts.—T. S. 70,000 to 78,000 lbs. el. 22% in 8 in.
	.....	12 in 20 ft.	.....	
	.....	15 in 10 ft.	.....	
	.....	15 in 10 ft.	.....	
A	55% ult.	12 in 10' med. 14 in 10' soft	Not more than ⅛ to break in eye.	
A	27,000	14 in 10 ft.	Not more than ⅛ to break in eye.	
over under	50% ult., 2 in. over 55% ult., 1 in. under	14 in 10 ft.	Not more than ¼ to break in eye.	High Steel { El., 40,000 lbs. red. 38 to 30% T. S. 70 to 80,000 lbs., el., 22 to 18% in 8 in. Q bend. | Med. phos. .06A to .04B, Sul. .05, Sil. .05, Mn. .70. High phos. .07A, Sul. .05, Sil. .06, Mn. .80.
	32,000	10 in 20 ft. Red. 40	Not more than ¼ to break in eye.	
	30,000	15 in 20 ft.	For bars 8 sq. in. and less.	Not more than ⅛ of bar to break in head.
	29,000	10 in 10 ft.	For bars over 8 sq. in. to 20	
& less q. in.	⅛ ult.	15 in 10 ft.	Reduction 30 to 2 %.	Opening and closing tests for angles.
	28,000	10 in 10 ft.	All bars must break in body.	
	⅛ ult.	10 in 20 ft. Red. 40	.....	
d.	27,000 soft 33,000 med.	14 in 12 ft. average 16	Not more than ⅛ to break in eye.	
	.....	.....	.....	El. for med. 26% for 57,000 lbs., T. S.—reduce ⅜% for each 1,000 lbs. down to 3
	30,000	12 in 15 ft.	Red. 40%.	High steel T. S. 66 to 74,000 lbs. el., 22%, red. 45%.
	.....	.....	.....	
	⅛ ult.	10 in 10 ft.	Not more than ⅛ to break in eye.	Opening and closing tests for angles.
	.....	10 in 10 ft.	Must break in body of bar.	
	.....	.....	.....	Opening and closing tests for angles.
	30,000	12 in 10 ft.	.....	
	.....	.....	.....	
	32,000	15 in 10 ft.	.....	
ft ed.	.....	.....	Not more than ⅛ to break in eye.	Punch tests.
ed.	.....	12½ med.	.....	
ft	.....	18 soft	.....	
	.....	.....	.....	

stern and Pittsburg & Lake Erie, same as L. S. & M. S., except phosphorus may be.08 for A. or B., O.H.

6. The two classes of structural steel for buildings shall conform to the following bending tests; and for this purpose the test specimen shall be one and one-half inches (1 1/2") wide, if possible, and for all material three-fourths inch (3/4") or less in thickness the test specimen shall be of the same thickness as that of the finished material from which it is cut, but for material more than three-fourths inch (3/4") thick the bending test specimen may be one-half inch (1/2") thick: **Bending Tests.**

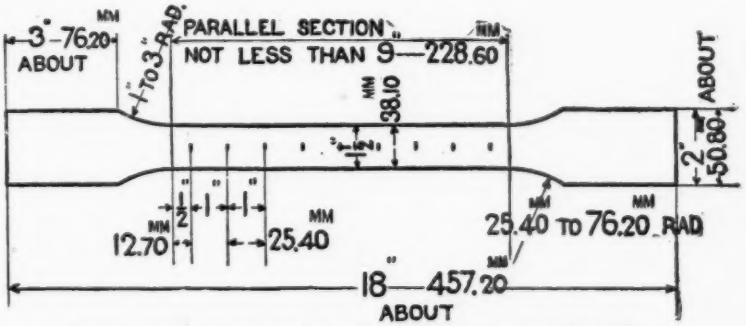
Rivet rounds shall be tested of full size as rolled.

(*d*). Rivet steel shall bend cold 180° flat on itself without fracture on the outside of the bent portion.

(*e*). Medium steel shall bend cold 180° around a diameter equal to the thickness of the specimen tested, without fracture on the outside of the bent portion.

Test Pieces and Methods of Testing.

7. The standard test specimen of eight inch (8") gauged length, shall be used to determine the physical properties specified in paragraphs Nos. 4 and 5. The standard shape of the test specimen for sheared plates shall be as shown by the following sketch: **Test Specimen for Tensile Test.**



For other material the test specimen may be the same as for sheared plates or it may be planed or turned parallel throughout its entire length and in all cases where possible, two opposite sides of the

test specimen shall be the rolled surfaces. Rivet rounds and small rolled bars shall be tested of full size as rolled.

8. One tensile test specimen shall be taken from the finished material of each melt or blow, but in case this develops flaws, or breaks outside of the middle third of its gauged length, it may be discarded and another test specimen substituted therefor.

Number of Tensile Tests.

9. One test specimen for bending shall be taken from the finished material of each melt or blow as it comes from the rolls and for material three-fourths inch (3/4") and less in thickness this specimen shall have the natural rolled surface on two opposite sides. The bending test specimen shall be one and one-half inches (1 1/2") wide, if possible, and for material more than three-fourths inch (3/4") thick the bending test specimen may be one-half inch (1/2") thick.

Test Specimen for Bending.

Rivet rounds shall be tested of full size as rolled.

(*f*). The bending test may be made by pressure or by blows.

10. Material which is to be used without annealing or further treatment shall be tested for tensile strength in the condition in which it comes from the rolls. For material which is to be annealed or otherwise treated before use, a full-sized section of tensile test specimen length, shall be similarly treated before cutting the tensile test specimen therefrom.

Annealed Test Specimens.

11. For the purposes of this specification, the yield point shall be determined by the careful observation of the drop of the beam or halt in the gauge of the testing machine.

Yield Point.

12. In order to determine if the material conforms to the chemical limitations prescribed in paragraph No. 2 herein, analysis shall be made of drillings taken from a small test ingot.

Sample for Chemical Analysis.

Variation in Weight.

13. The variation in cross section or weight of more than 2 1/2 per cent. from that specified will be sufficient cause for rejection, except in the case of sheared plates, which will be covered by the following permissible variations:

(*g*). Plates 12 1/2 pounds per square foot or heavier, when ordered to weight, shall not average more than 2 1/2 per cent. variation above or 2 1/2 per cent. below the theoretical weight.

(*h*). Plates under 12 1/2 pounds per square foot, when ordered to weight, shall not average a greater variation than the following:

Up to 75 inches wide, 2 1/2 per cent. above or 2 1/2 per cent. below the theoretical weight.

75 inches and over, 5 per cent. above or 5 per cent below the theoretical weight.

(*i*). For all plates ordered to gauge, there will be permitted an average excess of weight over that corresponding to the dimensions on the order equal in amount to that specified in the following table:

TABLE OF ALLOWANCES FOR OVERWEIGHT FOR RECTANGULAR PLATES WHEN ORDERED TO GAUGE.

The weight of one cubic inch of rolled steel is assumed to be 0.2833 pound.

Plates 1/4 inch and over in thickness.

Thickness of plate. Inch.	Width of plate. Up to 75 inches. Per cent.	75 to 100 inches. Per cent.	Over 100 inches. Per cent.
1/4	10	14	18
5/16	8	12	16
3/8	7	10	13
7/16	6	8	10
1/2	5	7	9
9/16	4 1/2	6 1/2	8 1/2
5/8	4	6	8
over 5/8	3 1/2	5	6 1/2

Plates under 1/4 inch in thickness.

Thickness of plate. Inch.	Width of plate. Up to 50 inches. Per cent.	50 inches and above. Per cent.
1/8 up to 5/32	10	15
5/32 " 3/16	8 1/2	12 1/2
3/16 " 1/4	7	10

FINISH.

14. Finished material must be free from injurious seams, flaws or cracks, and have a workmanlike finish.

BRANDING.

15. Every finished piece of steel shall be stamped with the melt or blow number, except that small pieces may be shipped in bundles securely wired together with the melt or blow number on a metal tag attached.

INSPECTION.

16. The inspector representing the purchaser shall have all reasonable facilities afforded to him by the manufacturer to satisfy him that the finished material is furnished in accordance with these specifications. All tests and inspections shall be made at the place of manufacture, prior to shipment.